

List Decoding Algorithms for Algebraic Codes

Amin Shokrollahi

Laboratoire de mathématiques algorithmique, PSE A 1.21,
1015 Lausanne, Switzerland

A list decoding algorithm for a code is an algorithm which, for a given input vector, recovers all codewords within a given Hamming radius e from that vector, for a given integer e . Sudan's algorithm was the first efficient list decoding algorithm for Reed-Solomon codes, this algorithm, and its subsequent conceptual generalizations by Shokrollahi-Wasserman, Guruswami-Sudan, and Koetter-Vardy, and algorithmic simplifications by Hoeholdt-Rasmussen, Roth-Ruckenstein, Pecquet, Olshevsky-Shokrollahi, and Gao-Shokrollahi are among the most efficient algorithms known to date for list decoding of algebraic codes, including Reed-Solomon and algebraic-geometric codes.

In this minicourse, I will introduce the codes involved (RS- and AG-codes), introduce the conceptual list decoding algorithms, and also discuss their efficient versions based on the theory of the displacement rank, a tool which originated in control theory. No prior pre-requisite is needed for this minicourse, except perhaps a first course on linear algebra.